and imbues each of these with functionality, stating "The regions on and associated with the template of Baker et al would obviously define plural selectable regions on and within a polygon around or/and on a display." (Office Action, p.6). With this statement, Examiner Weldon concludes that all the following arrangements would have been obvious in view of Baker:

1. plural selectable regions on a polygon around a display;
2. plural selectable regions within a polygon around a display;
3. plural selectable regions on a polygon on a display; and
4. plural selectable regions within a polygon on a display.

The mere recitation of "some sort of template" in Baker cannot and does not suggest each of these arrangements. Therefore, it would appear that Examiner Weldon is using personal knowledge to support his conclusion of obviousness of each of these arrangements. Applicant requests the Examiner provide a prior art reference or affidavit under 37 C.F.R. §107(b) to support each of these conclusions or withdraw the rejection.

Examiner Weldon states on page 8 of the Office Action, "One of ordinary skill in the art having Callahan et al (CHI '88) and Graf would have been motivated to realize the menu items in Baker et al as letters, numbers, or words." Neither Callahan nor Graf teach or suggest menu items as words *per se*. For example, Graf discloses menu items labeled with words representing aircraft information, e.g. air speed, and CHI '88 discloses menu items labeled with words representing computer operations, e.g. open. In the present claims, words are themselves the menu items, not a representation. The words themselves are spoken. It would appear that Examiner Weldon is using personal knowledge to support his conclusion that the prior art suggests menu items as words *per se*. Applicant requests the Examiner provide a prior art reference or affidavit under 37 C.F.R. §107(b) to support each of these conclusions or withdraw the rejection.

III. REMARKS

The paragraph numbers of the remarks below correspond to the paragraph numbers in the Office Action.

2. Claims 92 and 100 were not withdrawn from consideration, objected to, or rejected in the

Office Action. Applicant requests that the Examiner explicitly allow claims 92 and 100.

3. Amended claim 1 identifies the selectable region to be selected as the "particular" selectable region. New claim 107 depending from claim 1 correlates the first dwell event to the movement related signal as follows. The successive locations indicated by the movement related signal may intersect the particular selectable region. A duration of such an intersection is defined by the time interval between two of the successive intersecting locations. A function of the durations of periods of intersection is compared to a predetermined quantity. The first dwell event occurs at or near the time that the value of the function equals or exceeds the predetermined quantity.

The correlation between the dwell event and the movement related signal is further clarified in the Specification of the Application, which states:

> A dwell event includes, but is not limited to, each of the following: (a) the durations of one or more periods of intersection of locations indicated by a movement related signal, a body member or a cursor (including any part of the cursor) and a selectable region equalling or exceeding a predetermined period; (b) a first quantity responsive to the durations of the periods referred to in (a) equalling or exceeding a predetermined quantity; (c) dwell event (a) or (b) followed by a location indicated by the movement related signal, the body member or the cursor no longer intersecting the intersected selectable region; and (d) dwell event (a) or (b) wherein the period of intersection required for selection of a selectable region increases in response to a non-intersection or a period of non-intersection of locations indicated by the movement related signal, the body member or the cursor and the selectable region ("dynamic dwell event"). (Specification, p. 43, lines 1-10).

Claims 85, 90, 91, 92, and 98 have also been amended to be consistent with the new language of claim 1, i.e. the "particular" selectable region.

Claim 73 has been amended to provide an antecedent for the letters.

Claim 80 as written closely correlates the movement related signal and the periods of intersection of the cursor and one of the one or more selectable regions. In the moving step of the claim, the cursor is moved *responsive* to the movement related signal. The cursor intersects one of the one or more selectable regions. The durations of one or more periods of such intersection affect

the value of the first quantity.

Amended claims 85 and 94 each identify the selectable region to be selected as the "particular" selectable region and define the selection criteria within the claim.

Amended claim 106 identifies the selectable region to be selected as the "intersected" selectable subregion. New claim 113, depending from claim 106, further defines each dwell event and correlates each dwell event to the successive locations indicated by the movement related signal already described in the parent claim. In addition, dwell events are defined in the Specification (page 43, lines 1-10).

Each of the new claims 114 through 163 reads on Species VI, Speech Synthesis. These claims are directed either to a voice output system or a to method of speaking.

No new matter is added by this Amendment since voice output and dwell selectable menus are described in detail throughout the Specification, and appear elsewhere in the claims as originally filed.

6. This section of these Remarks, addressing the corresponding section of the Office Action, is composed of four parts: (1) an introduction including overview of what is claimed and the current status of the various claims; (2) the results of the interview of 18 October 1996 with Examiner Weldon, the Examiner previously assigned to this Application; (3) the affirmative case for the patentability of the pending claims over the cited references, and (4) a rebuttal addressing every argument advanced in the corresponding section of the Office Action not previously addressed in the affirmative case.

All independent claims, with the exception of claim 1, are directed to voice output. Individuals who use voice output systems usually do so because their normal speech is impaired. However, impaired speech is generally a symptom of a systemic disorder, e.g. cerebral palsy, which affects the individual's motor control. Speech is affected because normal motor control is required to produce intelligible speech. Frequently, the systemic disorder also impairs the individual's ability to physically control a machine such as a voice output system through its normal interface, a keyboard or a mouse, interfaces which require relatively good fine motor control and/or precise pointing skills. The invention solves, at least in part, several constituent motor problems that contribute to imprecise pointing, for example, overshoot, tremor, drift, inability to operate a switch while maintaining a pointer at a desired location, and involuntary movement accompanying voluntary movement (Specification, page 2, line 27 - page 3, line 6, and page 6, lines 16-18). Consequently, the invention

enables these individuals to control a voice output system and thereby verbally interact with their parents, teachers, fellow students, co-workers, and medical personnel.

The invention may be used by literate users through an orthographic interface, or by illiterate users through a symbolic interface using, for example, pictographs such as those shown in Figure 11 of the Application.

The invention includes a display area or surface including a working region with a periphery. Selectable regions are located adjacent the periphery of the working region. Each of the selectable regions has an external boundary which includes the side of the selectable region furthest from the working region. Additionally, each selectable region either has a confiner for preventing a movement related signal indicating a location from moving beyond the external boundary of the selectable region or has an activation area extending beyond the external boundary of the selectable region and beyond the display area. Each selectable region is associated respectively with a menu option which may be a sequence of one or more characters, a sequence of one or more words, or a sequence of one or more symbols representing the sequence of one or more words. The user points to a selectable region, the movement related signal indicating the location intersects a particular selectable region or its activation area and the associated menu option is selected and/or spoken by a voice output device.

There are seven principal features of the claimed invention. First, the invention enables a user to select a target region by pointing to it ("dwelling") for a predetermined period of time (the "selection threshold"). A user who cannot operate a switch while maintaining a pointer on a target may select by dwell. Second, selection may be responsive to a plurality of dwell periods. For example, the duration of these periods may be summed before comparison to the selection threshold. Plural dwell periods allows a user with tremor causing him to involuntarily cross out of the target region to make his intended selection. Third, selection may additionally be responsive to one or more periods during which the user does *not* point to the target, e.g. required dwell time may increase responsive to a period of non-intersection. Fourth, dwell time or the dwell time remaining before selection occurs may be indicated to the user so he knows his progress toward selection. Fifth, selectable regions may represent menu options in a menu hierarchy including a menu and a submenu, allowing a user to traverse the hierarchy with successive selections and so select a desired submenu option. Optionally, a displayed menu option may indicate the submenu options associated therewith. Submenu options may be arranged on the display to facilitate their selection by indicating in the displayed parent menu option the location of one or more of the submenu options or by minimizing the distance between the parent menu option and a submenu option likely to be selected. Sixth, the

location and arrangement of selectable regions with respect to the display and to one another, and the existence and/or penetrability or lack thereof of the external boundaries of the selectable regions may be manipulated to facilitate selection of an intended selectable region. Some claimed arrangements of selectable regions make use of large areas outside the display so that a selectable regions can be much larger than its size on the display. A large target is much easier for motor impaired users to select than a small one. Certain arrangements of selectable regions and their external boundaries create barriers to overshoot and/or drift, making them easier to select for imprecise pointers. Still other arrangements make use of a user's relatively unimpaired directional control in lieu of positional control. Finally, the invention may be implemented using a pointer or using a multiple position switch and a timer.

Claims 1, 6, 73, 80, 85, 86, 90, 91, 94, 98, 101, 104, and 106 stand rejected under 35 USC §103 as being unpatentable over Baker in view of Graf, WiViK2, CHI '88, Golding, and Lazzaro.

Claims 1, 73, 80, 85, 94, 106, 114, 134, 147, 158, 159, 160, 161, 162, and 163 are independent. Claim 1 is directed to an apparatus for selecting a menu option from a menu. All other independent claims are directed to voice output, either a method of speaking (claims 80 and 163), or a voice output system (all other independent claims).

An in person interview with Examiner Weldon, the Applicant, and the Applicant's attorney took place on 18 October 1996. At that time, all present agreed that, in a voice output device,:

1. selection responsive to a plurality of dwell periods, e.g. added time periods, is patentable;
2. dwell indication, e.g. changing color or intensity responsive to dwell, is patentable;
3. a menu hierarchy, e.g. dual level selection, is patentable; and
4. the Baker reference does not disclose or suggest what occurs when the operator moves or attempts to move the cursor outside the display.

Agreement was not reached on other issues.

The agreed upon patentable features and claims drafted to them are discussed immediately below.

1. selection responsive to a plurality of periods of intersection

   This feature is claimed in claims 104, 155-157, and 162.

2. dwell indication

   This feature is claimed in claims 90, 104, 134-146, and 160.

3. menu hierarchy

This feature is claimed in claims 92, 147-154, and 161.

The menu hierarchy feature was included in the claims examined in the Office Action. Claim 92 was pending on the date of the Office Action and was not withdrawn from consideration. Claim 92 depends from claim 90 which depends from claim 1. In claim 1, a menu option is selected. In claim 92, the selected menu option is associated with a submenu comprising a plurality of submenu options, and a submenu option is selected. In addition, independent claim 85 was pending on the date of the Office Action, and was rejected. Claim 85 claims an apparatus for selecting a menu option from a plurality of pluralities of menu options, i.e. a menu of menus. One of the menus is selected responsive to a sensor signal. The menu options of the selected menu are associated with selectable regions and one of the menu options is selected. Furthermore, Examiner Weldon's search, under MPEP 904.01(d), should have extended to all probable areas relevant to the claimed subject matter and should have covered the disclosed features which might reasonably be expected to be claimed. The elected species, Speech Synthesis, is illustrated in part by Figures 17 and 18 of the Application. These Figures depict a menu hierarchy, and the operation of the menu hierarchy shown in Figures 17 and 18 is described in the Specification at page 42, lines 1-18 and page 44, lines 21-29.

Since the above features were agreed to, arguments and evidence for their patentability are omitted from this Amendment. However, should the Examiner reject any of the claims to these features included in this Amendment, Applicant reserves the right to present argument and evidence in favor of their patentability.

In these Remarks, references are referred to as follows:

Reference	Cited herein as
U.S. Patent No. 4,586,035 to Baker et. al.	Baker
U.S. Patent No. 4,109,145 to Graf	Graf
WiViK2, Visual Keyboard for Windows 3.1 User's Guide, Prentke Romich Co., Wooster, OH: Prentke Romich Co., 1992.	WiViK2
Callahan, Jack; Hopkins, Don; Weiser, Mark; Shneiderman, Ben; "An Empirical Comparison of Pie vs. Linear Menus" in *Human Factors In Computing Systems: CHI '88*, Conference Proceedings, 1988.	CHI '88
Golding, V.G; Heneghan, M. J.; "Audio Response Terminal,"	Golding

IBM Technical Disclosure Bulletin, vol. 26, no. 10B, March 1984.

Lazzaro, Joseph J., "Computers for the Disabled," *Byte*, June, 1993. Lazzaro

The affirmative case for patentability is divided into two parts: (1) the scope and content of the pertinent prior art is ascertained, (2) for each claim, the differences between the pertinent prior art and the claim is described, as are the reasons for the nonobviousness of the claim.

I. Scope and content of pertinent prior art

The prior art must be pertinent to the claimed subject matter. 35 USC §103. Pertinent prior art includes subject matter falling into the same category of technology of that claimed and technology analogous thereto. Most of the claims of the present application are directed to (1) a voice output system; and (2) a method of speaking for users having impaired speech. This technology is classified in USPTO class 341, entitled "Coded data generation or conversion", subclass 23, entitled "Bodily actuated code generator, For handicapped user, Including keyboard or keypad, Variable key legends", and class 400, entitled "Typewriting machines", subclass 87, entitled "For operation by handicapped user". Analogous technology includes other bodily actuated code generators in class 341, subclass 22, entitled "Bodily actuated code generator, For handicapped user, Including keyboard or keypad".

The Baker reference is not pertinent prior art for pending claims directed to a voice output system or a method of speaking. Baker is not pertinent because it is not in the field of computer access for the handicapped (class 341, subclass 22 and 23, and class 400, subclass 87) and does not address a problem pertinent to the problem addressed by the claimed invention. Baker's goal is minimizing menu space requirements in order to maximize the screen area available to applications. "The present invention maximizes the screen area available to the operator for document and data display in the windows both during the functional operations of the display as well as during selection of menu items." (Baker, col. 2, lines 29-32). The problem addressed by most of the pending claims (all except 1, 6, 90, 91, 92, 98, 100, 111, and 158) is voice output for individuals with impaired speech, a completely different problem, and one not addressed by Baker.

The Graf reference is not pertinent prior art for the pending claims because it is not in the field of computer access for the handicapped (class 341, subclass 22 and 23, and class 400, subclass 87) and it does not address a problem pertinent to problem addressed by the pending claims. Graf's goal is to utilize the line of sight of an equipment operator because his hands and feet are busy. "There are a number of situations where a human being wishes to control certain equipment while at the

same time keeping his field of vision within a certain range. Often these situations involve the use of the operator's hands to an extent where additional control requirements for the hands are undesirable." (Graf, col. 1, lines 13-18). The problem addressed by most of the pending claims, as described above, is voice output for individuals with impaired speech, a completely different problem, and one not addressed by Graf.

Another factor distancing the field of Graf from that of the claimed invention is the motor skill of the intended operator. Graf describes systems intended for individuals with normal motor control. Indeed, the Graf reference discloses a device intended for use by aircraft pilots, individuals screened for their physical fitness. Individuals with impaired motor function are prohibited from piloting aircraft.

Graf would not be consulted by a person of ordinary skill in the art seeking to design a computer interface solution for individuals with neurogenic motor disorders impairing their motor control. It is common knowledge in the art that these individuals have tremor causing the user's head to move involuntarily. Devices which rely on line of sight, such as the device disclosed in Graf, require that the user's head remain substantially still. At the time the invention was made, line of sight devices were not considered suitable for these individuals.

II. Differences between the prior art and the claims

The discussion below assumes *arguendo* that Baker and Graf are pertinent prior art within the meaning of 35 U.S.C. §103.

The following discussion is organized by claims. First each complex claim is described, focusing on how the structural elements cooperate to produce the end result. Next, the structural, operation, theoretical and functional differences between each claim and each of the cited reference and the combination of the cited references is described. Then differences between the claim as a whole and the combination of the cited references are pointed out. The discussion below addresses the pending claims in the order of a depth first traversal of the claim tree.

Claim 1 is directed to an apparatus for selecting a menu option from a plurality of menu options. The apparatus comprises a display area and means for at least partially delimiting a plurality of selectable regions *outside* the display area. Each selectable region is associated respectively with a menu option. The user selects a menu option by selecting the associated selectable region. Selection is accomplished by dwelling on the selectable region.

There are many differences, structural, operational, theoretical and functional, between the

apparatus of claim 1 and the combination of references described in the Office Action. These differences are discussed below, starting with the structural differences between claim 1 and each of the cited references.

Baker is relied upon in the Office Action as the primary reference. Baker discloses external areas *on* the display, as shown in Figure 3 of Baker. Although Figures 8 and 9 of Baker do not show the full display area, Baker clearly indicates that the windows shown in Figures 8 and 9 are *smaller* than the display area. "FIG. 8 is a diagrammatic representation of a window ... such as that shown in FIG. 3" (Baker, col. 3, lines 53-55). FIG. 9 depicts "window 42 of FIG. 8 and the area surrounding the periphery 41 of this window" (Baker, col. 7, lines 5-7). Consequently, Baker's external areas are *on*, not outside, the display because the exterior box shown in Figure 9 is smaller than the display.

Locating external areas *on* the display is fully consonant with the purpose of Baker; locating external areas outside the display area is not. The object of Baker's invention is to increase the screen real estate available for information display by making menu items, e.g. page up, page down, virtual. "The present invention maximizes the screen area available to the operator for document and data display in the windows both during the functional operations of the display as well as during selection of menu items." (Baker, col. 2, lines 29-32). Baker accomplished his object by *time multiplexing* screen real estate, i.e. using the same space at different times for two different functions: (1) displaying information in a window, and (2) displaying a menu item. Time multiplexing space means that Baker's virtual menu items and information must reside in the same space to serve Baker's purpose. If Baker's external areas were located *outside* the display, they cannot be used for information display. External areas *outside* the display save no space. A static template, such as that shown in Baker's prior art Figure 2, would serve as well. Consequently, modifying Baker, as proposed in the Office Action, so that the external areas are *outside* the display makes Baker inoperable for its intended purpose. "Where a reference would have been inoperable for its intended purpose if modified to show the claimed invention, then it does not establish prima facie obviousness because it effectively teaches away from the claimed invention." *In re* Gordon, 733 F.2d 900, 221 U.S.P.Q. 1125 (C.A.F.C. 1984). Thus Baker teaches away from the proposed modification.

The Office Action states that "the patent to Baker et al only requires one 'window of lesser dimensions than' the display screen (Office Action, page 6), relying upon the preamble of claim 1 of Baker. The preamble reads, "In an interactive display terminal comprising a display screen having at least one window having lesser dimensions that said display screen ..." (Baker, col. 11, lines 31-33). However, the preamble is broader than the actual utility of Baker's invention, and Baker makes that

explicit in his disclosure. Of the problem he is addressing, Baker says "the menu must occupy a substantial portion of dedicated screen space *which might otherwise have been occupied by data windows*" (Baker, col. 4, lines 22-24, emphasis added). If Baker is implemented with only *one window* on the display, and that window is of lesser dimensions than the display, Baker's invention saves *no space* whatsoever. The virtual menu is not time multiplexed with anything. Only when you have multiple windows do Baker's virtual menus yield any advantage. Thus Baker is inoperative for its intended purpose if implemented using only one window. Consequently, Baker teaches away from using virtual menus and only one window. *In re* Gordon, *Ibid.*

Claims 1, 94, 114, 126, 119 and 108 have selectable regions or activation areas outside the display area.

Another very important difference between claim 1 of the Application and Baker concerns their respective menu items. Baker discloses *virtual* menu items, described in Baker's claim 1 as menu items which are "not displayed in normal operation" (Baker, col. 11, line 39), but are displayed when invoked (Baker, col. 4, line 50-56 and 67). Locating virtual menu items on the display is consonant with the purpose of Baker. If Baker's menu items were visible during normal operation, they would take up screen space, could not be time multiplexed, and would render Baker inoperable for its intended purpose. In particular, visible menu items result in "the exclusion of ... a dedicated regions from the display throughout ... operations". (Baker, col. 2, lines 26-28). This is just what Baker seeks to avoid. Thus, Baker teaches away from *visible* menu items. *In re* Gordon, *Ibid.* By contrast, the menu options in Applicant's claim 1 are normally displayed.

Turning now to the operational differences between Baker's disclosure and the apparatus of Applicant's claim 1, assume that an operator of Baker's invention points to a location beyond the display. Baker does not address what occurs in this case. Although Examiner Weldon states on page 10 of the Office Action that Baker suggests an overshot subregion, in fact Baker is silent. If Examiner Weldon suspects that Baker handles overshot subregions, he is must state the basis for his suspicion. *In re* Lunsford, 357 F.2d 385, 148 U.S.P.Q. 721, 725 (C.C.P.A. 1966). From the silence of Baker, one might conjecture that Baker's invention could confine the cursor to the display area. Or it might not. However, "[t]he mere fact that a prior art structure *might possibly* function as claimed or be modified in a way that would render the claims obvious does not render such claims obvious within the meaning of 35 USC §103." *Ex parte* Seiler, 215 U.S.P.Q. 742 (B.P.A.I. 1982), emphasis added.

Using selectable regions *outside* the display, as claimed in Applicant's claim 1, yields results

not attained by Baker alone or in concert with the other applied art. For example, many individuals with neuromuscular disorders, e.g. cerebral palsy, ("NMD operators") are unable to use a keyboard and lack the fine motor control required to point to and dwell on small targets such as those disclosed in Figure 3 of Baker (Specification, page 6, lines 5-9). In addition, many of these individuals are unable to maintain a steady pointer position and simultaneously operate a switch, whether that switch is a mouse button or a switch adapted for use by this population (Specification, page 6, lines 16-18). The combination of selectable regions located outside the display so that they are not limited in size by the display, and selection by dwell permits NMD operators to make selections and, in so doing, choose from a menu (Specification, page 11, lines 7 and 23). Further, locating the selectable regions outside the display keeps the display available for information display.

Another difference in results follows from having selectable regions *outside* the display. Selectable regions outside the display are not limited in size by the display, and consequently, they may be very wide. Within limits, as the width of a selectable region increases, the time required to position a pointer on that selectable region decreases, in accord with Fitts's Law. Fitts, P.M., "The information capacity of the human motor system in controlling the amplitude of movement, *Journal of Experimental Psychology*, 1954, vol. 47, pp. 381-391. Fitts hypothesized that a given human movement has a characteristic index of difficulty, called ID.

$ID = \log_2 (2A / W)$

where

A = average amplitude of a human movement

W = target width

Within limits, movement time is a function of ID, according to the equation:

$MT = a + bID$

where

MT = movement time

a = constant

b = constant

ID = index of difficulty

Investigators, with minor exceptions, have reported findings that provide general confirmation of Fitts's theory. (see citations reported in Fitts, P.M. and Peterson, J.R., "Information capacity of discrete motor responses", *Journal of Experimental Psychology*, vol. 67, pp. 103-112, 1964, at page

104, col. 1, line 41 - col. 2, line 2).

Thus, the mean movement time MT of an apparatus having selectable regions *outside* the display differs from the mean movement time of an apparatus having selectable regions *on* the display, due to (1) the increased mean distance A between the cursor starting position (assuming a starting position in the center of the display), and to (2) the large potential width W of the target.

Each of (1) Baker and Graf, (2) pie menus, and (3) the present invention have a different and characteristic index of difficulty ID. The index of difficulty of the present invention is substantially greater than that of pie menus because the present invention requires a substantially larger movement amplitude, A. The index of difficulty of the present invention is substantially smaller than that of Baker and Graf because the present invention has a substantially larger target width.

In accord with Fitts's Law, mean movement time is shortest in pie menus, longer for the present invention, and longer still for Baker and Graf. Consequently, selection from a menu, a key constituent of which is movement time, is faster for the present invention than Baker or Graf, all other factors being equal.

Indeed, the authors of one of the cited references, CHI '88, explain the results of their investigation of pie and linear menus in terms of Fitts's Law. "An analysis of seek time based on Fitts's Law ... helps explain our results because the ratio of the distance (D) to target size (S) is smaller for pie menus. The fixed target distance and increased size of targets for pie menus decreases the mean positioning time as compared with linear menus." (CHI '88, page 99, col. 1, lines 1-11.)

There is a slight discrepancy between Fitts's Law as stated in CHI '88 (CHI '88, p. 99, col. 1, lines 1-11) and in Fitts 1964. Fitts's Law, reproduced in CHI '88, states:

$$T = K_0 + K\log_2 (D/S + 0.5)$$

where

T = time to position cursor using mouse (seek time)

K_0 = constant time to adjust grasp on mouse

K = constant normalization factor (positioning device dependent)

S = size of target in pixels

D = distance in screen pixels

CHI '88 calculates S as an area; it's size is listed in terms of pixels squared. However, according to Fitts 1964, S is a measure of the width, not area, of the target. This discrepancy does not alter the conclusion that, as the width of a selectable region increases, the time required to position a pointer on that selectable region decreases.

Another difference between the apparatus of claim 1 and Baker concerns selection. In claim 1, selection is responsive to a dwell event. Baker does not disclose or suggest selection responsive to a dwell event. Baker's method of selection has multiple steps:

1. wait for mouse input and convert this input into a first location on the screen (Baker, col. 9, lines 29-32);
2. determine if there is an intersection of the location and one of the areas 1-12 (Baker, col. 9, lines 36-38);
3. if there is an intersection, hide the cursor and display the appropriate virtual menu item; (Baker, col. 9, lines 52-55);
4. wait for mouse input and convert this input into a next location on the screen (Baker, col. 9, lines 60-64);
5. determine if there is an intersection of the next location and area 0, i.e. the normal window (Baker, col. 9, lines 64-69);
6. if the mouse button has been pressed, implement the function represented by the displayed menu item (Baker, col. 10, lines 1-5).

Baker discloses *displaying*, not selecting, a virtual menu item responsive to the cursor crossing a peripheral region of the window (Baker, col. 3, lines 1-3). As implemented in Baker's preferred embodiment, the *display* of a virtual menu item is responsive to the intersection of two cursor locations and an external area. "[A] safeguard is built into the system to insure that the operator truly intended to cross into Area=5 and thus *bring up* the MOVE SCREEN menu item. Accordingly, step 86, next mouse input is waited for and converted to the new location." (Baker, col. 9, lines 57-62, emphasis added). Baker discloses *selection* responsive only to a press of the mouse button (Baker, col. 6, line 44, col. 10, lines 1-13, 44, and 65). "[T]he procedure awaits the operator to press the appropriate mouse button so that the function represented by the MOVE SCREEN menu item may now be implemented ..." (Baker, col 10, lines 2-5).

The Office Action concedes that "Baker et al never explicitly states the cursor remains in the region for the complete certain time." (Office Action, p.10) A dwell event, as defined above, includes a *period* of intersection. Independent claims 1, 80, 85, 94, 106, 134, 158, 159, 160, 161, 162, and 163 require either at least one period of intersection or a *period* in which the position of a positionable switch corresponds to the position of a menu option.

Another operational difference between Baker and the apparatus of claim 1 concerns the result

of the different cursor paths. Baker discloses displaying menu items responsive to the cursor crossing the periphery of a window adjacent to that menu item. If the cursor crosses the periphery in the center segment of the window periphery, no menu items are displayed. "[B]y moving the cursor across a preselected portion or region of a window periphery, the menu item representative of a particular function to be performed on the data within said window becomes displayed.... It is *only* when a selected region of this ordinary periphery is crossed by the cursor that an associated menu item becomes displayed." (Baker, col. 2, line 58 - col. 3, line 2, emphasis added). Referring to Baker's Figure 9, cursor movement from interior box 59 to area 1 and then left to area 5 does not cause the display of the menu item associated with area 5, whereas cursor movement from interior box 59 left to area 82 and then up to area 5 does cause the display of the menu item. The present invention allows the user to cross any segment of the window periphery. Users with impaired motor control often cannot cross out of the window precisely where they intend. Indeed, some individuals cannot control a diagonal movement, say from the upper left of a display directly to the lower right, instead move vertically down, then horizontally to the right. The apparatus of claim 1 permits a user with impaired motor control to chose the cursor path to the target selectable region that's best for him.

The discussion below assumes *arguendo* that Baker discloses selection responsive to an intersection of the cursor and one of the external areas.

A dwell event according to the present invention requires at least one *period* of intersection of locations indicated by a movement related signal, a body member or a cursor and a selectable region (Specification, page 43, lines 1-16). A dwell event is described in claim 107, dependent from claim 1. Baker is responsive to the mere *intersection* of the cursor and one of the areas 1-12. This occurs in step #2 above. The next location, tested in step #5 above, need not intersect the area intersected by the first location for the menu item associated by the cursor in step #2 to be selected on the next press of the mouse button. This is evident from a careful review of Baker.

Suppose a display as shown in Baker's Figure 9, and that the cursor is moved from Area 0 to an exterior area, say, Area 5, then immediately to Area 1, and the mouse button is then pressed. Control flows through the USER_INTERFACE procedure diagramed in Figures 10A and 10B as follows. Step 81 retrieves mouse input and calculates a new location in Area 5. Step 82 calls the INSIDE procedure, which returns 5. Step 83 tests the returned value from INSIDE and control passes to step 86. In step 86, the cursor is hidden and the menu item for area 5 is displayed. Step 86 retrieves mouse input and calculates a new location, now in Area 1. Step 87 calls the INSIDE procedure, which returns 1. Step 88 tests the returned value from INSIDE and control passes to step 90 since

INSIDE did not return 0. Step 90 detects the mouse button press. In step 91 the menu item is removed from the display. In step 92 the selected function is executed. In step 93 the normal cursor is again displayed. Thus, assuming that Baker discloses selection responsive to (1) an intersection, and (2) a button press (Baker, col. 10, lines 1-5), Baker is responsive to an intersection alone, not a *period* of intersection.

Assuming for purposes of argument that Baker is responsive to two cursor locations intersecting an external area, Baker still does not disclose or suggest selection by dwell. Baker does not disclose or suggest anything comparable to the selection threshold in the present invention or selecting a menu item responsive to a value equalling or exceeding the selection threshold.

Significantly, nothing in Baker teaches or suggests selection responsive to a dwell event *absent* a mouse button press. Claim 110 claims selection responsive *only* to a dwell event.

Selection responsive to a dwell event provides a result not attained by Baker's apparatus. Many NMD operators are unable to operate a switch while simultaneously maintaining a pointer in a target region. This may be due, for example, to tremor or to unintentional movement of one body member as a result of intentional movement of another body member, both of which are common in individuals with severe cerebral palsy. Such individuals would be unable to select the virtual menu items of Baker. However, since selection according to claim 1 is responsive to a dwell event, no switch operation is required. Thus, such a user can select a menu option using the apparatus of claim 1.

Invention may reside in discovering the source of a problem, as well as its solution. *In re* Kaslow, 707 F.2d 1366, 1373, 217 U.S.P.Q. 1089, 1094 (C.A.F.C. 1983). This is part of "the subject matter as a whole" and should always be considered when determining the obviousness of an invention under 35 USC §103. *In re* Sponnable, 405 F.2d 578, 585, 160 U.S.P.Q. 237, 243 (C.C.P.A. 1969).

Applicant observed individuals with neuromuscular disorders, in particular, cerebral palsy, during computer access . Many NMD operators, especially those with more severe impairments, cannot effectively use the conventional point and click or point and dwell (on-screen keyboard) computer interface (Specification, page 6, lines 5-9) because they cannot point precisely. Applicant isolated several constituent motor problems that contribute to imprecise pointing, for example, overshoot, tremor, drift, and involuntary movement accompanying voluntary movement (Specification, page 2, line 27 - page 3, line 6, and page 6, lines 16-18). Moreover, Applicant observed that the directional control exhibited by these individuals is often relatively good. The

Applicant's discovery of the *source* of the problem of imprecise pointing is nonobvious. Consequently, applicant's claimed method and apparatus for solving this problem satisfies the nonobvious requirement of 35 USC §103.

The apparatus of claim 1 addresses each of the identified constituent problems in a single device and uses NMD operators' directional control ability in lieu of motor skills this population lacks. The large, dwell selectable regions of the apparatus of claim 1 forgive tremor and drift and allow a user who cannot maintain a steady pointer position while operating a switch to select a desired menu option. Locating the selectable regions outside the display enables a user who tends to overshoot his target to select from a menu. A configurable selection threshold allows a user for whom involuntary movement is a problem to correct a partially involuntary movement before the selection threshold expires and thus avoid an unintended selection.

Turning to the cited art, Baker discusses two "templates". The first, indicated by reference number 31 in Figure 2, is a template used in the prior art, according to Baker. This prior art template is a "legend ... that may be mounted anywhere on the display...." (col. 4, lines 31-33.) The second, hereinafter "Baker's template" is a template that may be used with Baker's invention. "At first, the operator may use some sort of template or other learning aid *outside* of the screen to learn the relationship of peripheral regions to menu items." (Baker, col. 5, lines 33-35, emphasis added). Baker's template is simply a learning aid, for use until the operator learns which menu items are adjacent to the respective peripheral regions (col. 5, lines 30-34). Given the depiction of the template 31 in Figure 2, the use of the plain meaning of the word "template" which implies a static form, and that Baker does not differentiate between the template in the prior art and the template he suggests as a learning aid, it is reasonable to conclude that: (1) Baker's template is static; and (2) Baker's template does not constitute an operating element of the invention since (a) the prior art template does not constitute an operating element of the prior art, and (b) the use of Baker's template is temporary. There is no suggestion in Baker that the template or any part of it plays an active role in menu selection, such that pointing to a region on the template activates the display of one of Baker's virtual menu items or plays *any* functional role in the selection of a virtual menu item. Baker's template has no selectable regions, no virtual menu items, and no actuated menu items. By contrast, the selectable regions of the invention, and in particular claim 1's selectable regions outside the display, play an integral role in menu selection. In operation, for example, the user moves a pointer generating the movement related signal. The movement related signal indicates successive locations with respect to the display area. The successive locations intersect a selectable region *outside* the display area.

Selection is responsive to a dwell event, which occurs when the duration of the period of intersection equals or exceeds a predetermined period, called the selection threshold.

Baker states that "[a]t first, the operator may use some sort of template or other learning aid *outside* of the screen to learn the relationship of peripheral regions to menu items." (Baker, col. 5, lines 33-35, emphasis added). Contrary to Examiner Weldon's finding, this does not suggest a "four sided template to surround at least the periphery 41 of window 42" (Office Action, p. 6). Window 42 has dimensions less that the screen, as explained above. Thus, if Examiner Weldon's template directly surrounds window 42, then it too has dimension less than the screen. However, Baker does not disclose or suggest a template smaller than the screen. Indeed, Baker teaches away from such a modification of the template. Assuming such a shrunken template was implemented, it would circumscribe the File 1 window in Figure 3 of Baker. The shrunken template would obscure the File 2 and File 3 windows as well as the virtual menu items when displayed. If window 42 was moved around the screen by the operator, the shrunken template would not be aligned with the peripheral regions. A shrunken template would not fulfill its stated pedagogic purpose, since the novice operator could not easily see how moving the cursor across a selected segment of the periphery caused a virtual menu item to display. Furthermore, it is not obvious how one overcomes these difficulties. In addition, a shrunken template would "result in the loss of what can be a substantial portion of an already very crowded small display screen (Baker, col. 2, lines 13-14), exactly the problem Baker is trying to solve. In Baker's invention, "there are substantially no dedicated portions of operational screen which cannot be used for display purposes during functional operations" (Baker, col. 2, lines 64-67). A shrunken template would occupy portions of operational screen, making these portions unusable for display purposes during functional operations. How would an operator activate a dormant window in a system so modified? The most probable scenario is that an operator would have to remove the template so he could see the entire screen, move the active window out of the way, click on the dormant window and drag it to the aperture in the shrunken template, then replace the template. The modification proposed by Examiner Weldon thus defeats the purpose of Baker. Therefore, it would not have been obvious to one of ordinary skill in the art that the template should circumscribe window 42 or have lesser dimensions than the screen; nor would it have been obvious that window 42 be surrounded on the screen by a plural sided figure. *In re* Gordon, *Ibid.*

Assuming that Examiner Weldon's template is not shrunken, but is, like Baker's, outside the screen, there still is nothing in Baker that discloses or suggests that the template or any part of it plays an active roll in menu selection or confining the cursor. Nonetheless, Examiner Weldon found that

"[t]he regions on and associated with the template of Baker et al would obviously define plural *selectable* regions *on* and within a polygon around or/and on a display." (Office Action, p. 7, emphasis added). With this statement, Examiner Weldon concludes that all the following arrangements would have been obvious in view of Baker:

1. plural selectable regions on a polygon around a display;
2. plural selectable regions within a polygon around a display;
3. plural selectable regions on a polygon on a display; and
4. plural selectable regions within a polygon on a display.

Examiner Weldon's conclusion is both procedurally and substantively in error. Procedurally, the failure of Examiner Weldon to describe how the applied art makes each of these arrangements obvious, makes it impossible for the Applicant to examine the steps that brought the Examiner to each of these four separate conclusions. The Examiner is required to provide specific reasons how one of ordinary skill in the art would have found the claimed invention obvious. *Ex parte* Humphreys, 24 U.S.P.Q. 2d 1255 (B.P.A.I. 1992).

Substantively, this transformation of Baker's static template outside the screen warrants closer examination. According to the Office Action, each virtual menu item on Baker's screen sprouts a single shoot which takes root on the adjacent area of the template and grows into a non-virtual menu item residing *on* the template. In this transformation, the once virtual menu items become, like their offspring, non-virtual. This is apparently how the Office Action achieves non-virtual selectable region both on and outside the display. This transformation would not have been obvious to one of ordinary skill in the art.

There are five reasons why this transformation of Baker's template would not have been obvious given the teaching of Baker. First, Baker suggests only a static template, for the reasons described above. Nothing in Baker discloses or suggests that any part of the template is or should be an active component. Baker's template is a training tool, to be discarded when the operator becomes familiar with the distributed virtual menu. A training tool that is discarded cannot have functionality integral to the performance of the apparatus. In particular, nothing in Baker suggests that the template (a) includes a selectable region, or (b) confines the cursor.

The second reason for the nonobviousness of the transformation of Baker's template proposed in the Office Action is that if the menu items are visible in normal operation, there is no need for a template. This much is conceded by the Examiner's statement that the modified template would

"eliminate the need for the actuated menu items" (Office Action, p.6). Thus, Baker's disclosure teaches away from using *both* the template and visible menu items. However, assuming that the modified template confines the cursor, in discarding the modified template, the ability to confine the cursor is also discarded. Applicant's independent claims 73, 80, and 114 contain this combination of elements, i.e. *both* a confining polygon, confiner or confining step *and* visible menu items.

The third reason for the nonobviousness of the proposed transformation relates to "eliminat[ing] the need for the actuated menu items." Not only would the proposed modification eliminate the need, so too it would eliminate the benefit. So modified, the space saving benefit of Baker would be eliminated, since normally visible menu items consume screen real estate whether the menu items are needed or not. Where, in creating the structure of the claimed invention from a reference, the Examiner must "eliminate the need" for a critical element of the reference, here the actuated menu items of a virtual menu system, surely the reference teaches against, or at least fails to suggest, the proposed modification.

The fourth reason for the nonobviousness of the proposed transformation of Baker's template is simply Baker's use of the word "template". The word implies a form that fits over the display, surrounding the screen. Such a template would cover anything underneath it. Assuming *arguendo* that regions outside the display are suggested by Baker, now they must migrate to a location *on top of* the template.

Fifth, Baker's focus is virtual menu items, not non-virtual, i.e. visible, menu items. Visible menu items occupy valuable screen real estate. Baker's explicit purpose is to maximizes the screen area available to the operator for document and data display. By making menu items virtual, Baker captures the screen real estate used in Baker's prior art for menus (see Baker Figures 1 and 2) for information display. Transforming the virtual menu items into visible selectable regions on *and* within a polygon ..." (Office Action, p.7) defeats the purpose of Baker. Visible selectable regions located within a polygon on the display are on the screen, and thus occupy screen real estate. Thus, Baker teaches away from the transformation put forth by Examiner Weldon. *In re* Gordon, *Ibid.*

The template disclosed by Baker is a learning tool. The template conceived by Examiner Weldon, whether around or on the screen, is entirely different. Examiner Weldon's template has taken is an integral, fully functioning element of apparatus envisioned by Examiner Weldon. Whether this template would have been obvious or not, it is misleading to refer to Examiner Weldon's template as "the template of Baker" (Office Action, p. 7).

Claim 1 is considered patentable.

Claim 6, dependent from claim 1, makes clear that each of the successive locations may be either a relative location, .e.g. a location relative to a previous location, or absolute, e.g. relative to a fixed location on the display area.

Claim 98, dependent from claim 6, is directed to voice output. Claim 98 specifies that the particular selectable region represents a sequence of one or more words. The apparatus of claim 98 comprises a voice output device for speaking the sequence of one or more words responsive to the selection of the particular selectable region.

Assuming *arguendo* that Baker does suggest, as argued in the Office Action, that one of ordinary skill in the art might:

1. move Baker's template from around display to on the display, i.e. circumscribing a window;
2. move selectable regions from beneath the template to on top of it;
3. change the selectable regions from static element to active elements of the apparatus; and
4. make the selectable regions dwell selectable;

one of ordinary skill in the art requires some suggestion to combine Baker, so modified, with Lazzaro or another references disclosing a voice output device.

The fact that Lazzaro and Baker share a desktop computer is not sufficient to direct the attention of one skilled in the art looking at one of these references to the teaching of the other reference. Furthermore, while Lazzaro teaches adding a speech synthesizer to a desktop computer, this is irrelevant under 35 USC §103 which requires analysis of obviousness of a claim as a whole, not novelty of an element thereof. Hartness Int'l, Inc. v. Simplimatic Engineering Co., 819 F.2d 110, 2 U.S.P.Q.2d 1826 (C.A.F.C. 1987). Lazzaro discloses *visible* selectable regions ***on*** the display. Baker teaches against *visible* selectable regions. Neither Baker nor Lazzaro does not disclose or suggest selectable regions *outside* the display area. Baker is directed to "maximiz[ing] the screen area available to the operator for document and data display" (Baker, col. 2, lines 29-30). Baker does not disclose or suggest an apparatus for voice output or any voice output device. Baker discloses the following menu functions: close, size, move screen, scroll up, scroll down, scroll left, and scroll right (Baker, Figure 2 and col. 9, line 57). Baker does not teach or suggest a menu item comprising a sequence of one or more words. Without a suggestion in Baker to combine Baker with Lazzaro or another reference disclosing a voice output device, Examiner Weldon is simply picking and choosing elements from references, which is improper hindsight. *In re* Fritch, 972 F.2d 1260, 23 U.S.P.Q. 2d 1780, 1783-84 (Fed. Cir. 1992), quoting *In re* Fine, 837 F.2d 1071, 1075, 5 U.S.P.Q. 2d 1596, 1600 (Fed. Cir. 1988).

The apparatus of claim 98 provides a critical new result, a result not attained by the methods and apparatuses disclosed in any of the cited references. Because of their imprecise pointing skills, many NMD operators, for example, those with cerebral palsy, cannot reliably or efficiently use on-screen keyboards such as Lazzaro (Specification, page 6, lines 5-9). On-screen keyboards are generally used by individuals with high level spinal chord injury. These users, unlike those with cerebral palsy, have normal motor control of their heads and consequently can control the cursor with a head pointer, pointing and dwelling accurately.

The apparatus of claim 98 solves the problem of imprecise pointing, at least in part, by providing for large selectable regions outside the display.

The combination of claim 98 is believed to be patentable.

Claim 109, depending from claim 98, specifies that the particular selectable region is invisible. The operation of Baker's menu items, virtual during normal operation, but visible when invoked (Baker, col. 4, lines 50-56), is critical to realizing Baker's goal: maximizing screen area for information display. In the apparatus of claim 109, the particular selectable region is always invisible. The particular selectable region thus differs from Baker's menu item in that it is not visible when invoked and it does not transition between visible and invisible states. Baker's template is visible at all times. Were the template invisible, it would not perform its pedagogic function of indicating virtual menu items. Because Baker does not disclose or suggest an invisible selectable region, claim 109 is considered patentable independently of its parent claim.

Claim 90, depending from claim 6, claims a feature of the invention. Claim 90 includes indication means for indicating the remaining dwell time required to select the particular selectable region and the menu option associated therewith. The patentability of this feature was agreed to in the in-person interview. Therefore claims 91-93, each depending from claim 90, are patentable.

Claim 91, dependent from claim 90, is directed to voice output. The reasons for the non-obviousness of voice output have been described above in connection with claim 98.

Claim 92, also dependent from claim 90, further limits claim 90 by associating the menu option of the particular selectable region with a submenu comprising a plurality of submenu options. The submenu options are displayed upon selection of the menu option. The user may select a submenu option by dwell.

Claim 92 was not withdrawn from consideration, objected to, or rejected in the Office Action.

Claim 93, depending from claim 90, adds to the apparatus a plurality of selectable regions on the display area. Each of these is associated with one of the selectable regions outside the display

area. The first quantity is further a function of the duration of a period of intersection of two of the successive locations and one of the selectable regions on the display area. The selection means is further operative to select the menu option associated with the selectable region outside the display area associated with the intersected selectable region on the display area.

Applicant requests that the Examiner reverse the withdrawal of claim 93 from consideration, since claim 93 depends from a claim 90 which claims a feature agreed to be patentable.

Claims 91, 92, and 93 are deemed patentable.

Claim 100, depending from claim 6, limits claim 6 by adding signal generating means for generating a device control signal. The selected menu option represents a device control function. On selection by dwell, the signal generating means generates the device control signal represented by the selected menu option.

Claim 100 was not withdrawn from consideration, objected to, or rejected in the Office Action.

Claim 100 is believed patentable independently of its parent claim.

Claim 111, depending from claim 100, enumerates some devices which may be coupled to and controlled by the apparatus of claim 100. Claim 111 is believed patentable.

New claim 107, depending from claim 1, is described in section 3 of these Remarks.

New claim 108, depending from claim 1, limits claim 1 by requiring that at least one of the selectable regions be completely delimited. This limitation differentiates the apparatus of this claim from Baker. Assuming *arguendo* that Baker discloses or suggests confining the cursor to the screen and therefore has the effect of creating external areas outside the screen, these external areas are all unbounded. If the cursor is confined to the screen, it is so confined regardless of how far off the screen it is moved. Even such an expansive reading of Baker, does not suggest a *bounded* selectable region outside the display area. Claim 108 is considered patentable.

Independent claim 73 is directed to a voice output system for a user having impaired speech. Unlike claim 1 and its dependent claims, the plurality of selectable regions are visible and are located *on* the display within a polygon. Each selectable region is adjacent a side of the polygon such that together the selectable regions at least partially circumscribe a region on the display. Each selectable region is associated with a sequence of one or more letters. In addition to these elements, the voice output system comprises a voice output device and control means. The control means has three functions: (a) moving a cursor within the polygon responsive to a movement related signal; (b) appending selected sequences of letters together responsive to a succession of selection events; and (c) speaking the word spelled by the appended sequences.

The voice output system of claim 73 differs from the combination of cited references in many respects. Baker, it should be noted, is not directed to, and is not capable of, outputting speech for a user having impaired speech. Baker discloses only some of the elements of claim 73. Undisclosed in Baker are:

1. a plurality of *visible* selectable regions on the display;
2. a confining polygon *on* the display;
3. one or more selectable regions associated respectively with a sequence of one or more *letters*;
4. a voice output device;
5. control means for appending selections; and
6. control means for speaking the appended selections.

As stated previously, Baker teaches away from displaying, during normal operations (Baker, col. 2, line 51 and col. 5, lines 26-30), visible selectable regions on the display. Therefore, Baker inherently can not be combined with other references, relied on by Examiner Weldon, which utilize visible selectable regions.

The combination put forth in the Office Action does not contain a confining polygon, either on the display or elsewhere. If the Examiner believes that a confining polygon is inherent in the applied art or in the proposed modifications to that art, the Examiner must so state so Applicant can respond to the assertion.

Alternatively, if it is the modified template that confines the cursor, the Examiner should so state.

A confiner, confining polygon or confining step is an element of claims 73, 80, 112, 114, 120, 121, 146, 147, 155, and 158.

In addition to the differences already described between each of claims 1 and 98 and Baker, claim 73 adds an additional feature not found in Baker: spelling through successive selections.

The apparatus of claim 73 provides a critical new result, a result not attained by the methods and apparatuses disclosed in any of the cited references. As stated previously, because of their tendency to overshoot, many NMD operators cannot reliably or efficiently use on-screen keyboards. By confining the cursor to the polygon and locating the selectable regions within the polygon adjacent to its side, these operators can overshoot their intended selectable region and *still select it*. This result flows from the synergy between the polygon, the control means, and the location of the selectable regions.

Some of the other elements not disclosed in Baker are present in other references cited by in the Office Action. However, Baker cannot be combined with these references for the reasons described above and in connection with claim 98.

Claim 73 is believed patentable.

Claim 104, depending from claim 73, limits claim 73 by adding the following elements:

1. the movement related signal is responsive to the *head movement* of the user;
2. each of the plurality of selectable regions is adjacent an edge of the display;
3. each of the succession of selection events includes a *plurality* of periods of intersection of the cursor and the intersected selectable region, each of the plurality of periods of intersection having a total duration equalling or exceeding a predetermined period; and
4. the selection means further includes means for indicating the difference between the predetermined period and the total duration of the plurality of periods.

Baker does not disclose or suggest means for responding to the head movement of the operator, but only for responding to mouse movement (Baker, col. 5, lines 68, col. 9, line 30, col. 10, lines 24 and 52). As described in connection with claim 73, the selectable regions of claim 104 are visible, distinguishing them from the virtual menu items of Baker. As described in connection with claim 1, Baker does not disclose or suggest selection by dwell. Assuming *arguendo* that Baker discloses a *single* period of intersection of the cursor and an external area, claim 104 differs in that it claims a *plurality* of periods of intersection. None of the cited references discloses means for indicating remaining dwell time.

Individuals with tremor may involuntary cross out of a selectable region or may oscillate across the edge of a selectable region. Accumulating dwell time on a selectable region, as claimed in claim 104, compensates for tremor. On return to a selectable region, the user need only dwell for a period equal to the difference between the selection threshold and the previously accumulated dwell time for that selectable region. Claim 104 is considered patentable independently of its parent claim.

Claim 112, depending from claim 73, specifies that the control means moves the cursor only with the polygon. Examiner Weldon equates Baker's exterior box 41 (Baker, Figure 9) to the polygon. This exterior box 41, corresponds to periphery 41 of window 42, shown in Figure 8 (Baker, col. 7, lines 14-20). Exterior box 41 is a polygon on the display. However, Baker's exterior box "merely performs its normal function of defining the window." (Baker, col. 2, line 67 - col. 3, line 1) Baker does not disclose or suggest that this exterior box 41 or any part of it should confine the cursor

within the box. This however is the function of the polygon, in concert with the control means, in claim 112. Claim 112 is believed patentable.

Independent claim 80 is directed to a method of speaking using a voice output system. The system includes a display displaying a plurality of selectable regions within a polygon. Selectable regions are located adjacent the sides of the polygon and at least partially circumscribe a region on the display. One or more of the selectable regions is associated respectively with a sequence of one or more characters. A cursor is moved within the polygon responsive to a movement related signal. The user selects a sequence of characters by dwelling on the associated selectable region. The selected sequences of characters are appended and the word spelled by the appended sequences is spoken by a voice output device.

Many of the differences between claim 80 and the applied art have already been discussed in connection with claim 73. However, claim 80, a method claim, introduces an additional factor must be considered: the user's motivation for employing this method. Users of voice output systems generally have a disorder affecting their motor control. One symptom of the disorder is impaired speech. Another symptom is impaired ability to voluntarily stop motion, resulting in a tendency to overshoot on-screen targets. Others symptoms may include reduced ability to prevent the movement of parts of the body, including the head, limbs and digits, muscle stiffness, weakness, limited range of motion, abnormal posture, involuntary muscle tremors, involuntary muscle activity causing involuntary motion, impaired ability to voluntarily stop motion, impaired ability to coordinate muscle activity, and/or impaired ability to sense the position of a part of the body. Any one of these symptoms may impair an affected individual's fine motor control. Moreover, while some individuals affected by a neuromuscular disorder may be able to exercise fine motor control with enormous effort, the struggle to do so often fatigues the individual, limiting the period of time the individual is capable or comfortable performing the fine motor control task (Specification, p.2, lines 5-13). Due to these symptoms, and particularly impaired ability to voluntarily stop motion, individuals with neuromuscular disorders tend to overshoot on-screen target areas. The confining step of the method of claim 80 in combination with the location of the selectable regions adjacent the polygon of the claimed method, enables some of these individuals to select targets they otherwise could not, or to do so more quickly or with less effort and concomitant fatigue.

Neither Baker nor Graf teach or suggest a method of speaking. One of ordinary skill in the art viewing Golding and Lazzaro would not have considered either Baker or Graf pertinent and consequently neither of these latter references may be combined with either of the former.

Claim 80 is considered patentable.

Independent claim 85 is directed to multimodal selection from a plurality of menus. The apparatus includes a plurality of pluralities of menu options, i.e. a plurality of menus. A user indicates which one of the menus he desires. A sensor signal receiving means detects the user's indication and associates respectively the menu options of the selected menu with selectable regions. The user selects the desired menu option by dwelling on the associated selectable region.

None of the cited references disclose or suggest multimodal selection from a plurality of menus, and none disclose the combination of sensor signal receiving means and a pointer.

A multimodal menu interface speeds user interaction for individuals with impaired motor capability. If the user is able, he can select a menu with a first mode and, close in time, select from the selected menu by dwell. Multimodal interfacing is faster than single mode interfacing. In single mode selection by dwell requires dwelling for at least two selection thresholds, one after the other. Multimode interfacing, in contrast, may require dwelling for only one selection threshold. In addition, the selection of the menu may overlap in time with the selection of the menu option from the selected menu. Since the speed of the interface is usually the limiting factor in man-machine interactions for individuals with impaired motor capability, the improved efficiency of the interface results in greater productivity.

Claim 86, depending from claim 85, comprises indicating means for indicating which plurality of menu options is associated with the selectable regions. This feature is not disclosed in any of the cited references.

Claim 101, depending from claim 85, is directed to voice output. In claim 101, the selected menu option represents a sequence of one or more words. The apparatus further comprises a voice output device for speaking the sequence of one or more words responsive to the selection. Lazzaro discloses both these elements, but not in combination with either sensor signal receiving means or selectable regions at least partially *circumscribing* a region on the display. The combination claimed in 101 facilitates man-machine interaction for individuals with impaired motor capability, as described in connection with claims 1 and 73.

Claims 85, 86, and 101 are considered patentable.

Independent claim 94 is also directed to voice output. In claim 94, an invisible selectable region is *completely* delimited *outside* the display area. The selectable region is associated with a sequence of one or more words. Upon selection of the selectable region by one or more dwell periods, the sequence of one or more words is spoken by a voice output device.

The apparatus of claim 94 differs from the cited art for the reasons described in connection with claim 1. In addition, even if one were to assume for purposes of argument that an external area of Baker could properly be modified to be unbounded on the side furthest from the center of the display, such a modified external area would extend to infinity. Given this modification to Baker, once an operator would move his mouse to the display edge, further mouse movement beyond and perpendicular to the display edge would have no effect, since the location indicated by the mouse would still intersect the unbounded external area. Claim 94 differs from this modified Baker in that the selectable region of claim 94 is bounded. Consequently, if the user is using a head pointer and turns his head crossing through the selectable region and beyond it, the successive locations indicated by the movement related signal would not intersect the selectable region. This feature enables the apparatus of claim 94 to avoid an unintended selection in the case where the user turns substantially away from the display, for example, to face someone next to the user.

Claim 94 is believed patentable.

Independent claim 106 is directed to a voice output system for a user having impaired motor capability. Claim 106 claims an apparatus for selecting a menu option associated with an overshot selectable subregion on a display. The apparatus comprises a voice output device, a display, a menu, and control means. The control means delimits a plurality of selectable regions, each associated with a menu option. Each selectable region includes a subregion adjacent the display and a subregion on the display. These subregions are adjacent one another. The plurality of the subregions on the display together at least partially circumscribe a region on the display. In response to a succession of dwell events, each associated with a subregion adjacent the display, the control means selects the menu option associated with the selected selectable region. Each of the menu options represents a sequence of one or more letters. The control means appends selected sequences of letters together and speaks them, by means of the voice output device.

In claim 106, the subregions on the display interact synergistically with the subregions adjacent the display ("paired subregions") to provide several new results. First, the intersected subregions in claim 106 are adjacent the display. Thus, a user who overshoots the subregion *on* the display still makes his intended selection. Second, the selectable subregion on the display serves to indicate the location of the associated selectable subregion adjacent the display. Third the menu option associated with paired subregions may be shown on the selectable subregion on the display. In this case, although the user cannot see the selectable subregion adjacent the display, he knows what menu option is associated with it.

In the Office Action, it is stated that "Baker et al also suggests the overshot subregion (i.e. exterior box - Fig. 9)" (Office Action, p.10). As described earlier, Baker is in fact silent on this question. Figure 9 does not depict anything outside and adjacent the display.

The Office Action continues in this same vein: "Further note Figure 3 of Callahan et al (CHI 88) suggest an area beyond a menu item can be associated with the menu item. Such would obviously be an overshot subregion." (Office Action, p. 10). In finding this suggestion, Examiner Weldon ignores the explicit contrary figure and statements of CHI '88. Figure 3 of CHI '88 shows a pie menu activation area extending *to*, not beyond, the screen boundary. Moreover, CHI '88 states, "the activation regions for pie menus are 'pie' shaped sections that extend *to* the screen boundaries (CHI '88, p. 97, lines 43-45, emphasis added.) CHI '88 does not address the question of an overshot activation region.

None of the cited references disclose or suggest an apparatus for selecting a menu option associated with an overshot selectable subregion. Likewise none of the cited references disclose or suggest delimiting selectable subregions adjacent a display. This topic was explored earlier in connection with Baker's template in the discussion of claim 1. None of the cited references discloses or suggests the combination of visible selectable subregions on the display adjacent to associated selectable subregions outside the display. Claim 106 is considered patentable.

In the Office Action, Examiner Weldon makes certain of assumptions concerning the prior art and the level of ordinary skill in the art and then makes a series of modifications to Baker, sometimes drawing on cited art, sometimes on his own personal knowledge. These assumptions and modifications are:

1. assume that Baker, Graf and CHI '88 are each prior art within the meaning of 35 USC §103;
2. use a single window;
3. shrink Baker's template until it circumscribes the single window;
4. move virtual menu items from beneath the shrunken template to a location on top of it;
5. make the virtual menu items visible at all times;
6. combine with CHI '88 to replace the menu items of up/down/open/close with letters or words;
7. combine with Graf to replace selection by button press with selection by dwell;
8. expand the modified menu items to include an entire selectable region;
9. add the capability of appending sequential selections;
10. combine with Golding to add voice output; and
11. substitute head control means or eye control means for Baker's mouse.

This a long chain of modifications, each one of which must be obvious within the meaning of 35 USC §103 to make the claimed combination obvious. A failure of any link in this chain is fatal to the *prima facie* case of obviousness. Furthermore, since 35 USC §103 requires that a patent be granted unless the invention "as a whole" would have been obvious, the *entire* chain of modifications from starting point to ending point must be obvious. In addition, the motivation to make each of combinations listed above must be found in the applied art. *In re* Lalu, 747 F.2d 703, 223 U.S.P.Q. 1257, 1258 (Fed. Cir. 1984).

Each assumption and modification is discussed separately below.

1. assume that Baker, Graf and CHI '88 are each prior art within the meaning of 35 USC §103

The pertinent prior art is discussed above in connection with claim 1.

2. use a single window

An implementation of a single window with Baker's virtual menu items is inoperative for the intended purpose of Baker, as discussed above in connection with claim 1.

3. shrink Baker's template until it circumscribes the single window

The two templates disclosed in Baker and the reasons why it is not obvious to shrink Baker's teaching template are discussed above in connection with claim 1.

Assuming *arguendo* that Baker suggests shrinking the teaching template, when does one stop shrinking the template? Assuming the purpose of the template remains pedagogical, the template might be shrunk to the size of the interior box of Baker's FIG. 9. In this configuration, the user sees a static menu item on the template and can observe the cursor crossing Baker's periphery region near the static menu item and the subsequent display of the virtual menu item. Thus, even if shrinking the template is obvious to try, shrinking it the correct amount, not to mention imbuing it with the ability to confine the cursor, is not obvious absent an indication of which parameters are critical or direction as to which of many possible choices is likely to be successful.

4. move virtual menu items from beneath the shrunken template to a location on top of it.

Examiner Weldon states on page 7 of the Office Action, "The regions *on* and associated

with the template of Baker et al would obviously define plural selectable regions *on* and within a polygon around or/and on a display." "The" regions on the template have no antecedent in the Office Action. They are created in this sentence. Baker does not disclose or suggest selectable regions on any template. Both the templates referred to in Baker are static, as described above in connection with claim 1. There is nothing in Baker or any other cited reference which discloses or suggests a template of any size, shape, or configuration having selectable regions thereon. The motivation for making this modification appears to be improper hindsight.

Examiner Weldon's template confines the cursor to window 42. Assuming menu items are *on* the template, such as Examiner Weldon deems obvious, the cursor cannot reach these menu items since the cursor is confined within the template. In juxtaposition, the polygon of claims 73 and 80 confines the cursor within the polygon. The selectable regions are also within the polygon. Thus the cursor may intersect any of the selectable regions.

5. make the virtual menu items visible at all times.

Examiner Weldon's contends that "Baker et al would have obviously suggested to one of ordinary skill in the art a display *on which may be displayed* a plurality of selectable regions within a polygon on the display.... Baker et al suggest virtual and *actual* menu items in peripheral regions around a window." (emphasis added) As described above in connection with claim 1, Baker teaches against displaying his virtual menu items during normal operation. "[A]ll of the items in the menu remain substantially virtual". (Baker, col. 2, lines 62-63). The advantages of Baker's invention flow from and depend on making the menu items virtual, not actual. Making the virtual menu items visible during normal operation renders Baker's invention inoperative for its intended purpose and is thus contrary to Baker's teaching.

Examiner Weldon states at page 6 of the Office Action that "the template [modified as suggested by Examiner Weldon] would eliminate the need for the actuated menu items." Examiner Weldon is re-engineering Baker, substituting his modified template for one of Baker's most critical elements. Baker is, after all, directed to selection of menu items. Wholesale change of this sort to the primary reference underscores the leap, alleged by Examiner Weldon to be obvious, required to fit Baker into the mold of the claimed invention.

Furthermore, since Baker teaches actuated menu item, it teaches against "eliminating the need" for them. In Baker, the virtual menu items must be present simultaneously with the

template to fulfill the purpose of the template, i.e. "advising [the operator] of the hidden or virtual menu items associated with each of the peripheral regions" (Baker, col. 3, lines 23-25) so that "the operator can quickly become familiar with and learn the menu items or functions displayed as a result of moving the cursor across the respective peripheral regions." (Baker, col. 3, lines 16-22) .

Examiner Weldon's selection of elements disclosed by Baker in common with the claimed invention and ignoring the teaching of Baker against actual menu items indicates picking and choosing elements from the cited art, using the Specification and claims of the present Application as a guide.

Before one implements a template in hardware, software, or firmware, one needs a motivation to do so. Assuming the motivation for the template remains Baker's motivation, i.e. teaching the novice user, what function will hardware, software or firmware perform consonant with this motive? Before "such a suggested template could have motivated one of ordinary skill in the art to implement the template in hardware, software or firmware to be on the display surrounding a window" there must be *some* advantage to this implementation. What would motivate one of ordinary skill in the art to replace Baker's static template with a more functional one, aside from the mere existence of the static template? Examiner Weldon's Office Action is silent on the question of motivation for this modification. Absent a an obvious or disclosed motivation, Baker does *not* "suggest virtual *and* actual menu items in peripheral regions around a window." (Office Action, p.7, emphasis added).

Examiner Weldon's failure to state what motivation he relies upon for his conclusion of obviousness makes it impossible for the Applicant to challenge that motivation. The Applicant cannot be expected to respond to hidden reasons for Examiner Weldon's conclusion of obviousness. *Ex parte* Humphreys, *Ibid.*

6. combine with CHI '88 to replace the menu items of up/down/open/close with letters or words.

Baker does not disclose or suggest menu items representing sequences of characters or words. To find these elements of the invention, Examiner Weldon combines Baker with Graf and CHI '88. However, "[w]hen the incentive to combine the teachings of the references is not readily apparent, it is the duty of the examiner to explain why combination of the reference teachings in proper...Absent such reasons or incentives, the teachings of the references are not combinable." *Ex parte* Skinner, 2 U.S.P.Q. 2d 1788, 1790 (B.P.A.I. 1987).

Examiner Weldon attempts to find an incentive to combine Baker with Graf or CHI '88 by stating that all are directed to pie menus. "Callahan et al (CHI '88 - page 96, first column) defines a pie menu as a menu where 'items in the menu are placed at equal radial distances along the circumference of a circle'. If the periphery 41 defining window 42 in Baker et al and the periphery arrangements in Figs. 1 and 2 of Graf are equated to a circumference, the invention of Baker et al and Graf are directed to pie menus." (Office Action, p. 8) However, neither Baker nor Graf are directed to pie menus, for several reasons.

a. Neither Baker nor Graf teaches placing menu items at equal radial distances along the circumference of a circle. The periphery 41 of defining window 42 in Baker's Figure 8 and the periphery arrangements in Figures 1 and 2 of Graf are rectangles, not circles. Examiner Weldon provides no basis for equating the periphery of either of these rectangles with the circumference of a circle.

b. All the pie menus described in CHI '88 are opaque. CHI '88 states on page 96, first column, line 19, "A pie menu is a system facility for pop-up menus". Pop-up menu are opaque. Consequently, items underneath the pie menu are obscured when the pie menu is displayed. CHI '88 acknowledges this drawback, "pie menus consume greater screen area and become polynomially larger than linear menus in both height and width with increased item size and number of items" (CHI '88, page 96, col. 2, lines 6-9), and "there remains the problem of increased screen real estate usage. In one trial a subject complained because the pie menu obscured his view of the target prompt message." (CHI '88, page 100, col. 1, lines 9-12). The inventions of Baker and Graf are not directed to pie menus. The window 42 of Baker and the display area of Graf are not obscured by their respective menus. In some ways this is advantageous, in other ways, disadvantageous, but unquestionably, distinct.

c. The short distance from the center of the display to a target menu item is one of the defining characteristics and major advantages of pie menus, resulting in its superior target seek time versus linear menus (CHI '88, page 98, col 2., lines 34-35). Due to this short distance, (10 pixels according to CHI '88, page 99, col. 1, lines 50-51) the user need only move the cursor by a small amount in some direction to highlight a pie menu item (CHI '88, page 96, col. 2, line 21). In contrast, both Baker and Graf require relatively large movements from the center of the display. To display a Baker virtual menu item, the user must move the cursor across the periphery of the window. To

indicate a Graf trigger area, the user must direct his line of sight at the trigger area adjacent the perimeter of the display. Thus neither Baker nor Graf shares this key characteristic with pie menus.

d. The speed of selection of a menu item in each of Baker and Graf differs from that of a pie menu, as described in connection with claim 1. Although pie menus obscure much of the display, "they enjoy a twofold advantage because of their unique design: items are placed at equal radial distances from the center of the menu and the user need only move the cursor by a small amount in some direction for the system to recognize the intended selection. The advantages of decreased distance and increased target size can be seen as an effect on positioning time as parameters to Fitts's Law." (CHI '88, page 96, col. 2, lines 17-24).

e. Baker, Graf and CHI '88 are each directed to different, unrelated problems. Baker's invention addresses the problem of maximizing the screen area available to the operator for document and data display (Baker, col. 2, lines 29-30). Graf's invention addresses the problem of controlling equipment while at the same time the operator keeps his field of vision within a certain range (Graf, col. 1., lines 13-15). The study documented in CHI '88 found that users were faster and more accurate with pie menus than with linear menus.

f. Graf discloses only line of sight detection. The signals referred to in Graf are signals "indicative of the direction in which an eye is looking" (Graf, col. 3, line 47). Graf does not teach pointing with any body member other than the eye.

g. Graf would not be consulted by a person of ordinary skill in the art for the reasons discussed in the section above entitled "Scope and content of pertinent prior art".

Consequently, it is improper to combine the teachings of Baker and Graf with CHI '88.

CHI '88 provides no motivation to realize the menu items in Baker as words. Words, and particularly words for voice output, are *not* among the menu items disclosed in either Baker or CHI '88. Baker discloses the following menu functions: close, size, move screen, scroll up, scroll down, scroll left, and scroll right (Baker, FIG 2 and col. 9, line 57). CHI '88 discloses the following menu items: compass directions, time, angular degrees, diametrically opposed or orthogonal function names, numbers, letters, ordinals, functions Login, Logout, Open, Close, Hardcopy, Shrink, Shape, Move, File, Save, Tie, Insert, Past and Cut (page 96, col. 2, lines 1-

2; page 97, col. 1, lines 5-8; page 95, Figure 1, page 100, Figure 6). CHI '88 teaches against including menu items of letters in a pie menu. "Lists, like number, letters and ordinals are best suited for linear menus" (CHI '88, p. 97, col. 1, lines 7-8).

Similarly, Graf Figures 1 and 2 fail to disclose menu items of letters or words. Figure 1 depicts a "display ... used by the observer to select a desired *control function* or to determine which of a plurality of available displays, such as instrument readings, is to be projected into the central area" (Graf, col. 3, lines 32-33, emphasis added). Figure 2 shows "a more detailed example of display 123 such as was shown in FIG. 1 as display 23" Graf, col. 6, lines 16-18). Thus the words appearing in Figure 2 are indicators for control functions. The control function, not the word itself, is the menu option. In all pending claim to voice output displaying a sequence of one or more words as a menu option for spoken output, the sequence of one or more word itself *is* the menu option.

7. combine with Graf to replace selection by button press with selection by dwell.

Examiner Weldon states no further reason to combine Baker with Graf or CHI '88 other than those described above. Since the stated reason (all three references directed to pie menus) is incorrect, neither Graf nor CHI '88 cannot be combined with Baker. In particular, Graf's disclosure of selection by a single period of continuous dwell cannot be substituted for the button press of Baker. CHI '88, even if it could be combined with Baker, does not disclose selection by dwell. "The process of selecting items from a pop-up menu, *regardless of format*, can be characterized in three stages: invocation, browsing, and confirmation. To make a selection, the user invokes the menu by pressing a mouse button (invocation), continues to hold the mouse button down and moves to an item which is then highlighted (browsing) and releases the mouse button confirming the selection (confirmation)." (CHI '88, p. 97, col. 2, lines 14-21, emphasis added).

The Office Action combines Graf's disclosure of selection by dwell with Baker. Graf, however, teaches away from the claimed invention because when combined with any method of operation other than line of sight, e.g. hand, the combination defeats purpose of Graf. When so combined with hand operation, Graf is not operable for its intended purpose: control of equipment while the hands and feet of the operator are busy (Graf, col. 1, lines 12-36). "Where a reference would have been inoperable for its intended purpose if modified to show the claimed invention, then it does not establish prima facie obviousness because it effectively

teaches away from the claimed invention." *In re* Gordon, *Ibid.*

Furthermore, Graf discloses *only* line of sight detection. The signals referred to in Graf are signals "indicative of the direction in which an eye is looking" (Graf, col. 3, line 47). Graf does not teach pointing with any body member other than the eye, so the hypothetical combination of Baker and Graf is a device in which menu items are displayed by eye movement and selected by eye fixation. Such a combination lacks the following elements of claim 1: selectable regions outside the display area, simultaneously displayed menu options, and selection responsive to a pointer other than the user's eyes,, appending of letters, selection of words and voice output.

Examiner Weldon does not state any reason to combine Baker, Graf, or CHI '88 with WiViK2. "When the incentive to combine the teachings of the references is not readily apparent, it is the duty of the examiner to explain why combination of the reference teachings in proper...Absent such reasons or incentives, the teachings of the references are not combinable." *Ex parte* Skinner, 2 U.S.P.Q. 2d 1788, 1790 (B.P.A.I. 1987).

Baker's advantage depends upon *virtual* menu items. Combining Baker with references relying on non-virtual menu items renders Baker inoperable for its intended purpose. Therefore Baker cannot be combined with these references.

8. expand the modified menu items to include an entire selectable region.

Examiner Weldon states that "Baker et al suggest virtual and actual menu items in peripheral regions around a window." (Office Action, p.7) Assuming *arguendo* that Baker and Graf are properly combinable, and that the displayed menu items of Baker can be equated to the menu items of Graf, the resulting combination is an apparatus in which only the "virtual and actual menu items" are visible. Nowhere does the Examiner state grounds for making the *boundaries* of the peripheral regions visible. Thus, the combination the Examiner states is obvious lacks a well defined peripheral region. The user has only the location of the visible menu item on the template to indicate the location of the peripheral region. In independent claims 73 and 80 the selectable regions are *displayed* on the display. Thus the boundaries of these selectable regions are clearly indicated to the user.

Furthermore, the proposed modifications and combinations yield virtual menu items as in Graf which the user must dwell on to select. All the claims of the present invention allows the user to select by dwelling *anywhere* in the selectable region or its activation area. Since the

user lacks fine motor control, he needs a large selectable region and/or activation area. The small virtual menu of the proposed combination is too small for the user to select. (Specification, p. 6, lines 5-14).

Thus, the proposed modifications and combinations deemed obvious by Examiner Weldon yield an apparatus which is neither structurally nor functionally equivalent to the claimed invention.

9. add the capability of appending sequential selections.

There is no finding in the Office Action that any of the cited references a disclose or suggest appending successive selected letters to spell a sequence of one or more words, as claimed in claims 73, 80, and 106.

10. combine with Golding to add voice output.

Examiner Weldon does not state what would motivation one of ordinary skill in the art viewing Baker to combine it with the speech synthesizer disclosed in Golding other than that both Baker and Golding use a display and that Lazzaro discloses that nonverbal people can use a speech synthesizer to speak. However, Golding, Baker, and the claimed invention are in different fields and each address different problems. Golding's audio response terminal is an attempt to address a problem in data entry, specifically "the drawback that the operator has to read the input data document and any reference to the screen or printer requires the operator's visual attention to be shifted from the source document.... This article describes a terminal which uses the addition of a speech synthesizer feature, to an existing VDU terminal to allow existing data/text entry programmes to operate with little or no change." (Golding, p. 5633, lines 8 - p. 5644, line 1).

Examiner Weldon cites the figure on page 62 of Lazzaro as a basis for combining Baker with Lazzaro. However, Examiner Weldon fails to note that the figure shows menu items that are simultaneously visible during normal operation. There are so many of them (over 40) that if they were virtual, the user would have a very difficult time remembering exactly where each was located. Baker, if combined with Lazzaro, becomes inoperative for its intended purpose and therefore cannot properly be combined with Lazzaro.

11. substitute head control means or eye control means for Baker's mouse.

Examiner Weldon states that head control means, eye control means, or hand control can be used in a computer system. These are illustrated, respectively, by Lazzaro, Graf, and Baker. However, that each control means can be used in a computer system designed to handle the peculiarities of the attached means, does not imply that these means are fungible. Indeed, the references indicate they are not. To illustrate, Baker discloses displaying virtual menu items responsive to a cursor, itself responsive to mouse movement, crossing a peripheral region. Graf discloses selecting target areas responsive to fixation of line of sight. Baker's mouse cannot simply be replaced by Graf's line of sight device, for the following reasons. First, Graf's line of sight devices does not have an integral component analogous to the mouse button of Baker. Second, Graf teaches that it is "undesirable to have a continuously varying signal on output lines 51 or 52 accompanying every movement of the eye 30. Such a situation would result in a confusing number of images being projected onto screen 25 and accidental control functions being performed with possibly disastrous results" (Graf, col. 4, lines 16-22). Third, nowhere does Graf suggest that the path of an operator's eye movement, i.e. crossing a peripheral region, is a reliable or useful indicator of the operator's intent. Indeed, Graf's fixation time is intended to filter out unintentional fixations (Graf, col. 4, lines 31-37).

Lazzaro discloses using a head-mounted pointing device in tandem with software to display a picture of the keyboard on the screen (Lazzaro, page 62, bottom of col. 1 - top of col. 2). Baker's mouse cannot simply be replaced by Lazzaro's head-mounted pointing device, for the following reasons. First, few individuals have fine motor control of their head comparable to the fine motor control of their hands. Second, people are generally unaccustomed to using their heads for pointing tasks. Third, the head-mounted pointing device disclosed by Lazzaro has no integral component analogous to the mouse button of Baker, but requires an external adaptive switch activated "by eye movements, breath control, or any other reliable muscle movement" (Lazzaro, page 62, col. 2). Fourth, the conventional mouse and head-mounted pointing device differ in how the user corrects for misalignment described in the Specification from page 16, line 15 through page 17, line 16. .

In conclusion, head control means, hand control means and eye control means each differ significantly from one another. They are not fungible.

In view of the foregoing, and in summary, claims 1, 6, 73, 80, 85, 86, 90, 91, 92, 93, 94, 98, 100, 101, 104, 106-163 are considered patentable over the cited references. Favorable

reconsideration of the Application, as amended, is respectfully requested.

Respectfully submitted,

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I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, DC 20231, on 19 November 1996.

Donald K. Forest — 19 November 1996

Donald K. Forest — Date of Signature